CHAPTER 1

Introduction to Navigation

Introduction

In this chapter, you will be introduced to the world of navigation. As a Quartermaster, you will be engaged in many aspects of navigation. As you will learn, navigation is known as both an *art* and a *science*. Don't be put off by the science end though, a basic knowledge of mathematics will suffice your needs. There is no feeling that compares to knowing that you are part of a team that **safely** navigates a ship and her crew across vast expanses of ocean.

You will be a highly visible member of the ship's crew, after all, your work station is on the bridge. The bridge is where the captain spends most of his or her time under way. The bridge is where the orders are given for the ship to carry out her mission. QMs traditionally maintain the highest standards of **grooming, pride, and professionalism.** You will become the trusted assistant of the navigator, bridge watch officers, and the captain.

Objectives

The material in this chapter will enable the student to:

- Describe a dead reckoned track.
- Describe the Terrestrial Coordinate System.
- Measure distance on a Mercator projection chart.
- Interpret chart symbology.
- Plot and extract positions on a chart.
- Plot direction on a chart.
- Determine chart accuracy.
- Find charts using DMA Hydrographic catalog.
- Describe the Chart Correction System and correct charts from *Notice to Mariners.*
- Order, label, and stow charts.

Topics

Origins and Primary Areas of Navigation

Background

From the beginning of recorded time, man has traveled on the water. He left port without the ability to steer a course. He was at the mercy of the sea, with his direction being determined by the wind and currents. Eventually, he faced the problem of how to get to where he wanted to go. As a result of this problem-solving process, navigation was born.

The early days of navigation were dubious at best. During this period in time, navigation was considered an art. This soon changed with the addition of science.

Modern day navigation has aspects of both, it is considered an art and a science. On one hand, navigation is a precise science comprised of complicated mathematics, precision instruments, and state of the art machinery. On the other hand, it is the skill in the use of these tools and the interpretation of information that is an art. Many operations conducted in the area of navigation require the use of precise instruments and mathematical tables and sound judgment based on experience.

The seasoned navigator uses all available information and a certain measure of judgment to say "Our position is here on a chart."

Primary Areas of Navigation

Navigation is divided into four primary areas: piloting, dead reckoning, celestial navigation, and radionavigation. These areas are listed in the sequence in which they probably evolved as knowledge and abilities progressed. We will now briefly look at each area.

Piloting

Piloting may be defined as the movement of a vessel with continuous reference to landmarks, aids to navigation, depth sounding, and radionavigation.

Example: Our early navigator probably departed port and set his or her course towards a distant landmark. This may have been any number of things, an offshore island or a lone jagged rock outcropping. The navigator steered on this landmark and tracked his progress by landmarks passing down the port and starboard sides of his ship.

Piloting as a technique has not changed. The difference between our early navigator and the present navigator is the use of technology.

Dead Reckoning

Dead reckoning (DR) can be defined as projecting an intended course and speed from a known point. As our early navigators ventured further from land, they needed a method to estimate position. With no visible landmarks to use as a reference, early navigators estimated course and speed on the chart. *Dead reckoning does not consider the effects of wind or current.*

Figure 1-1 illustrates a sample DR plot. From the 0800 fix the ship's course and speed is plotted. A DR plot is maintained on board naval vessels under way at all times. It is the best estimate of where the ship should be at any given time. The DR plot also gives the navigator a visual sign of whether the ship is steering towards danger or not. The DR plot will be covered in greater detail in chapter 8.

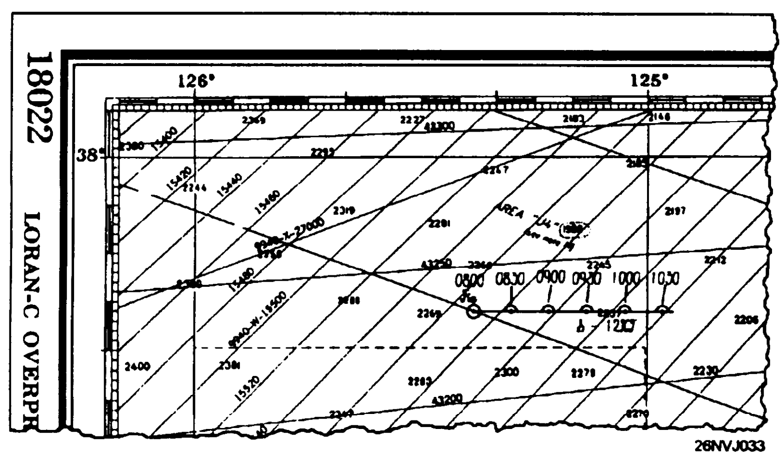

Figure 1-1. Example of a DR track.

Celestial Navigation

Celestial navigation may be defined as the practice of observing celestial bodies (the Sun, Moon, stars, and planets) to determine the ship's position.

The early navigators recognized the need to overcome the shortcomings of dead reckoning. They soon developed techniques to observe the heavenly bodies to determine their position. Although the instruments used first were crude, they have steadily improved. An experienced QM may now obtain a celestial fix within **one-tenth of a mile** of the ship's position.

Celestial Navigation

How is this accomplished? Measurements are taken of the height above the horizon of a celestial body. The measurement or sight, as it is commonly referred to, is then reduced by a mathematical procedure. The results are then plotted on the chart to determine position (fig. 1-2). Celestial navigation will be covered in greater detail in chapters 6 and 9.

Radionavigation

Radionavigation may be defined as the determination of position by the use of radio waves. There are several types of systems in use today. From the now seldom used Radio Direction Finder (RDF) to the latest satellite navigation system, what they **all** have in common is that they use radio waves. This area of navigation is now sometimes referred to as ***electronic navigation.*** This subject matter will be covered in greater detail in chapter 8.

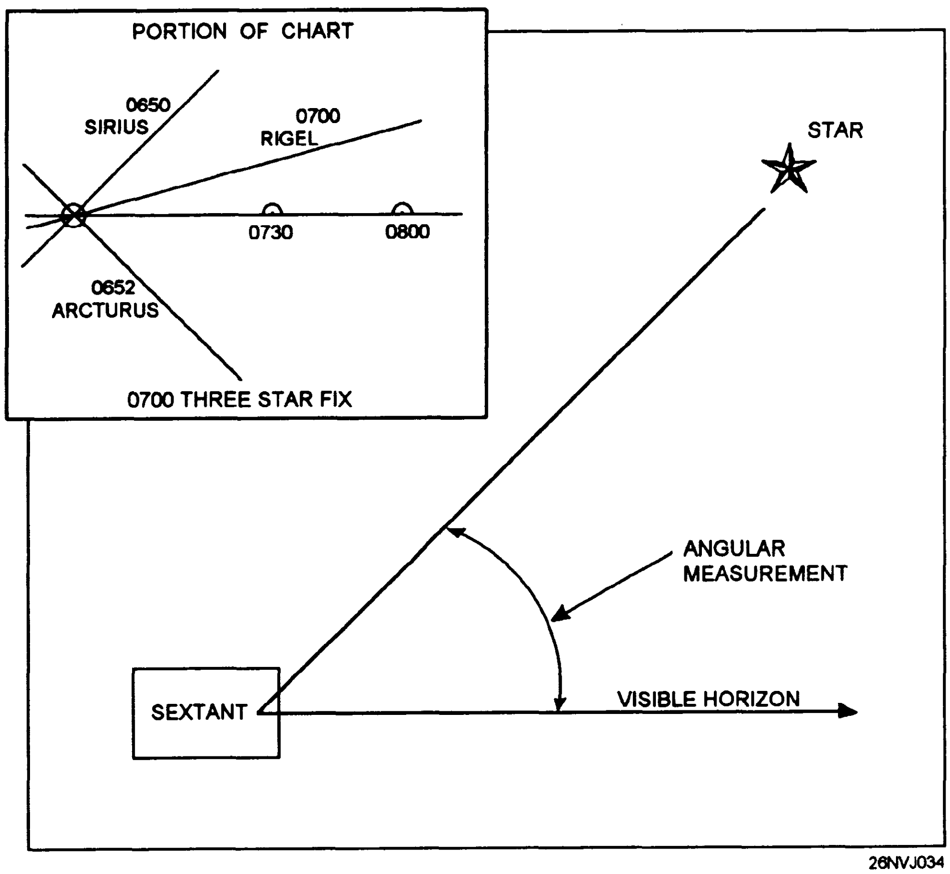

Figure 1-2. Sextant angle and sample 3 star fix.

Problems Associated with Navigation

Information

As you have learned, navigation is an art and a science. Our early navigators experienced the same problems that face the modem navigators. There are three major problems of navigation that must always be addressed. These problems are:

- How to determine position
- How to determine the direction to get from point A to point B
- How to determine the distance between points, the time it will take, and the speed as the navigator proceeds

Determining Position

Of the three problems facing the navigator, the most basic and also the most important is determining position. The ship's position must be known to safely and accurately direct the movements of the ship.

The term *position* refers to a known point on Earth. QMs refer to a position as a ***fix.*** It may also be qualified by an adjective such as *estimated* and *dead reckoned.*

Measuring Direction

Direction is the orientation of a line drawn or imagined joining two positions without any regard to the distance between them. Direction on charts is measured in angular units using a polar coordinate system (a coordinate system based on the North Pole and South Pole). The reference used is normally *true north.*

Figure 1-3 shows a line drawn between two positions. The direction may be determined from the compass rose. Direction is measured from 000° T through 360° T.

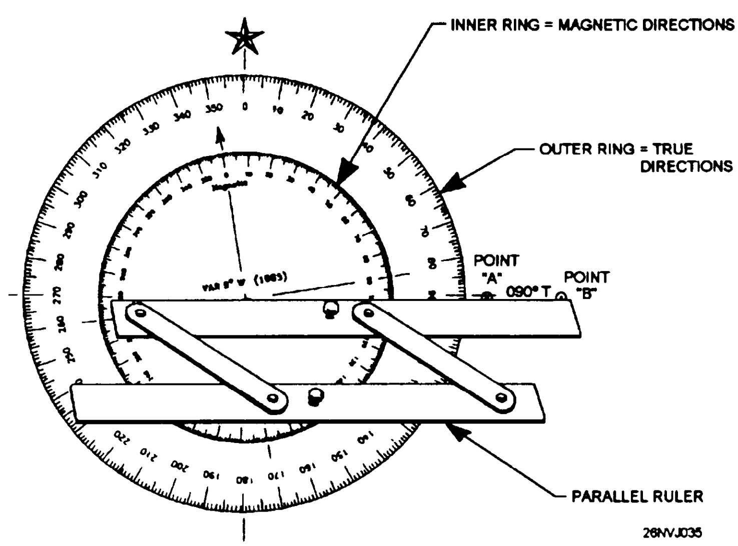

Figure 1-3. Compass rose.

Direction

Knowing the direction between two positions makes it possible for the navigator to lay a course from where he is to where he wants to go and then to proceed to that point. Direction will be presented in greater detail later in this chapter.

Measuring Distance

The distance between two points is the physical separation without regard to direction. Nautical distance is measured as the international nautical mile (nmi) of 6, 076.1 feet. The nmi is longer than the statute mile (mi) used on land, 5, 280 feet; 1.15/1 is a simple ratio often used to convert nmi to mi.

Time

Time in navigation is always based on the 24-hour clock. You are already familiar with this type of timekeeping as it is what we use in the military.

Speed

Speed is defined as the rate of movement. In navigation speed is referred to as nautical miles per hours or *knots* (kn).

We can now put this all together. We have defined the major problems associated with navigation. The solutions to these problems are contained in later text. We know that the navigator **must** determine position, direction, and distance to travel. But how does speed and time figure in this picture?

The Relationship Between Time, Speed, and Distance

That brings us to the time, speed, and distance triangle. If you know the distance you need to travel and at what speed you will proceed, you can use simple mathematics to determine how long it should take to travel that distance. This is a triangle, because if you know any two values (time, speed, or distance) you can solve for the unknown value. That brings us to the next subject. Where does this information go? How does one actually go from one known position to another known position safely? The answer is the nautical chart! The remainder of this chapter will explore the nautical chart and how the QM uses it.

Earth and the Terrestrial Coordinate System

Background

Before we begin to examine the nautical chart, we must first understand some facts about Earth itself.

Facts about Earth
It is **not** a perfect sphere
The diameter at the Equator equals approximately 6,888 nautical miles.
The polar diameter is approximately 6,865 nautical miles, or 23 miles less than the diameter at the Equator.
Technically it is classified as an oblate spheroid (a sphere flattened at the poles.)

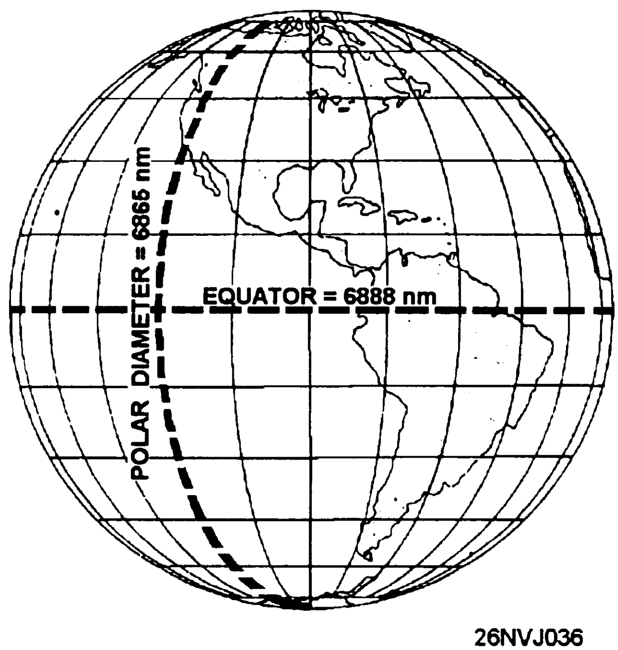

Figure 1-4. Earth.

For the purposes of navigation, we assume that we are working with a perfect sphere. The differences between the two diameters are small enough to be considered insignificant.

Nautical charts do NOT take Earth's oblateness into account.

Reference Lines on Earth

Information

To locate a position on Earth's surface, you must first have some point to start from. If you imagine Earth in motion, you will notice that it spins on its axis. The axis is the imaginary line drawn between the North Pole and South Pole that forms the first point of reference. The second point of reference is the Equator, which divides Earth into two parts, the Northern Hemisphere and the Southern Hemisphere.

We now have our starting points. For practical application in locating a position, two points of reference were not adequate so we had to create great and small circles around Earth.

Great Circles

A great circle is formed by a plane passing through the center of Earth. Figure 1-5 illustrates our imaginary line that connects the North Pole and South Pole. The great circle passes directly through the center of Earth, but more importantly, *around Earth's surface.* The Equator is also a great circle.

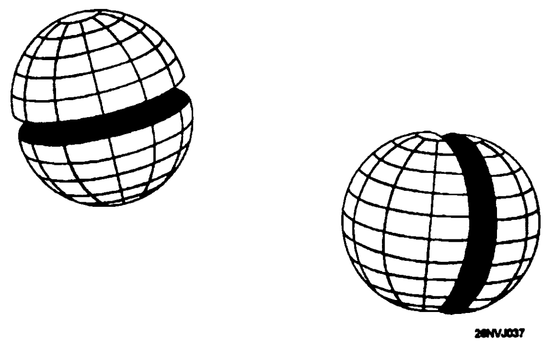

Figure 1-5. Examples of great circles.

Small Circles

A small circle is formed by planes that do not pass through the center of Earth. Figure 1-6 illustrates several small circles. How will these circles allow us to find our position? The answer is that certain great circles and small circles have special meaning for navigation purposes. They are called parallels of latitude and meridians of longitude.

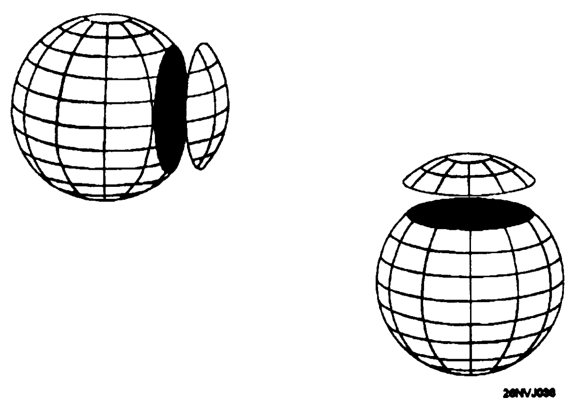

Figure 1-6. Examples of small circles.

Parallels of Latitude

Parallels are the small circles around and on Earth's surface. For navigation, parallels of latitude have been established. They are all parallel to the plane of the Equator. Figure 1-7 illustrates parallels of latitude. Since they are all parallel to the Equator, latitude can be measured towards the North Pole and South Pole.

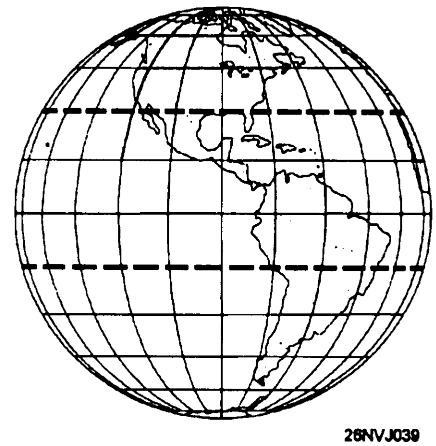

Figure 1-7. Examples of parallels of latitude.

How Latitude is Measured

Latitude is measured in degrees (°), minutes ('), and seconds (") north or south of the Equator. Measurements of latitude cannot exceed 90° in either direction. This is due to the fact that the Equator is always perpendicular (at a right angle) from the great circle that forms the plane through the North Pole and South Pole.

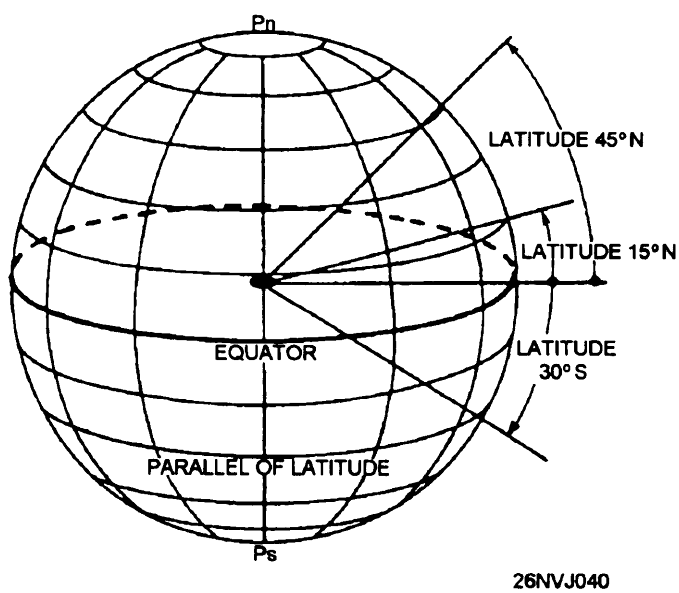

Figure 1-8. Measurement of latitude.

Figure 1-8 illustrates this clearly. Do not confuse angular expressions of minutes and seconds with units of time because they are unrelated.

Meridians of Longitude

Meridians of longitude are the great circles. They all pass through the center of Earth. The prime meridian or 0° of longitude is the starting point for all longitude measurements. Longitude is measured in same manner as latitude except that it is measured **east or west** throughout 180°. The prime meridian is also known as the Greenwich meridian. It is so named because is passes directly through Greenwich, England.

Latitude and longitude comprise the terrestrial or geographic coordinate system. Figure 1-9 illustrates how a position is located on a chart. We will discuss the mechanics of plotting a position on a nautical chart later in this chapter. Before we can do that we have to learn more about the charts we use.

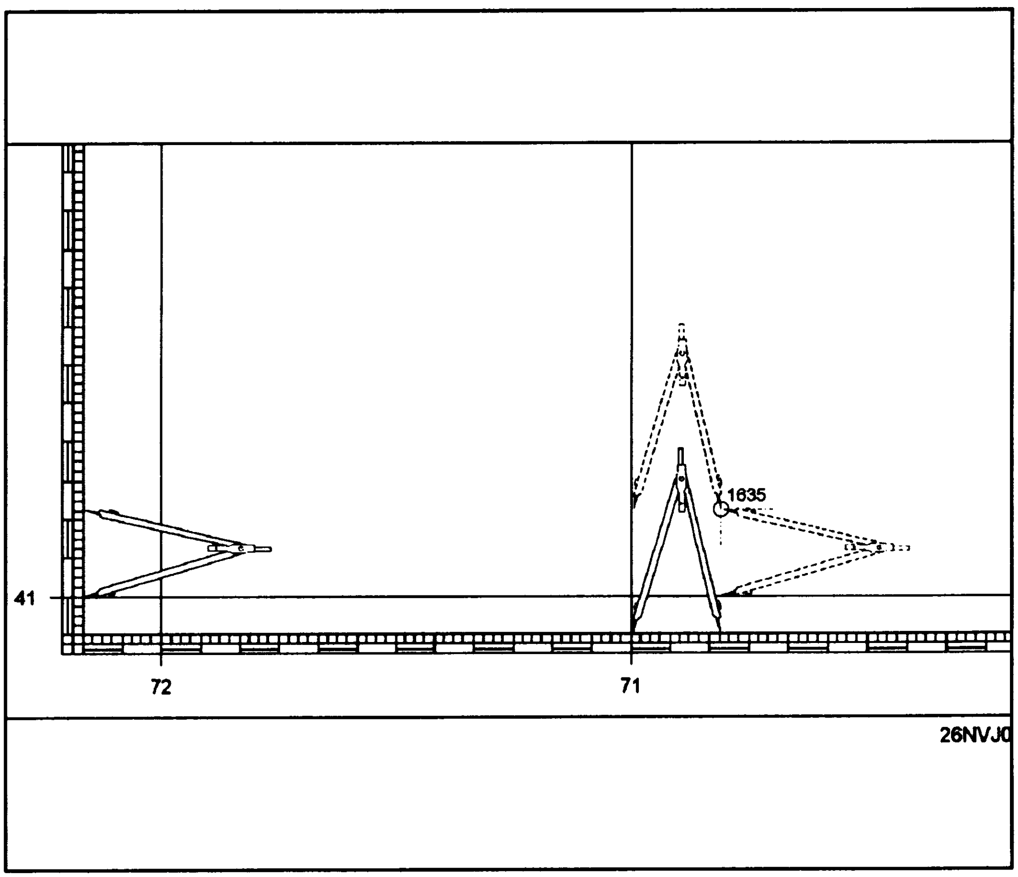

Figure 1-9. Locating a position on a nautical chart.

The Nautical Chart

Background

A nautical chart is like a road map for the world's oceans and inland waterways. The nautical chart is designed especially for navigation. A chart is a printed reproduction of Earth's surface showing a plan view of the water and land areas. It contains parallels and meridians to use when plotting a position, locating aids to navigation, and much more.

Chart Projections

The task of putting the round Earth on flat paper is a complex one. This text will not go into great detail on chart projections. More information on this subject may be found in *Dutton's Navigation and Piloting.* We will discuss the two projections most widely used in today's Navy and by mariners in general.

Mercator Projections

Mercator projection charts are the most commonly used navigational charts. Therefore, it is important that you understand the characteristics of these charts. The first thing to understand is that no navigational chart is perfect.

Example: Cut a hollow rubber ball in half and try to flatten it out, you cannot do so without tearing or stretching the rubber. In fact, no section of the hemisphere will lie flat without some amount of distortion. No system of projection has yet been devised that preserves the exact true proportions of the original sphere.

Mercator projections almost always display meridians and parallels. Meridians run from the top to the bottom of the chart, parallels run from the left to the right. Due to distortion in high latitudes, this projection rarely exceeds 70° north or south.

Advantages: The Mercator projection shows a rhumb line as a straight line. A rhumb line is nothing more than a compass course or direction plotted by the navigator to show that he will follow from his point of departure to his destination.

Gnomonic Projections

The gnomonic projection's chief advantage is that it plots a great circle as a straight line. This is most useful when planning long ocean passages. It is always best to take the shortest route from point A to point B. This projection will be covered in greater detail in chapter 12.

Nautical Chart Interpretation

Introduction

Figure 1-10 represents a portion of an average chart. This chart contains a lot of information. When you are in doubt of a specific symbol on a chart refer to U.S. Coast Guard Chart 1 in booklet form.

Chart 1 lists all standard symbology contained on a chart and is published in easy to use booklet format. A copy of chart 1 will be available in every charthouse, if you can't find one, a copy may be found in *Dutton's Navigation and Piloting.* But a copy of Chart 1 must be ordered!

Now let's take a closer look at the chart. If you have a copy of a chart and chart 1, get them to use as references while covering this material. Use figure 1-10 on the facing pages to identify the many items that may appear on a chart.

Note: Figure 1-10 does not contain all symbols and features that may appear on a nautical chart! However, many items that you will work with on a day-to-day basis are called out for your attention.

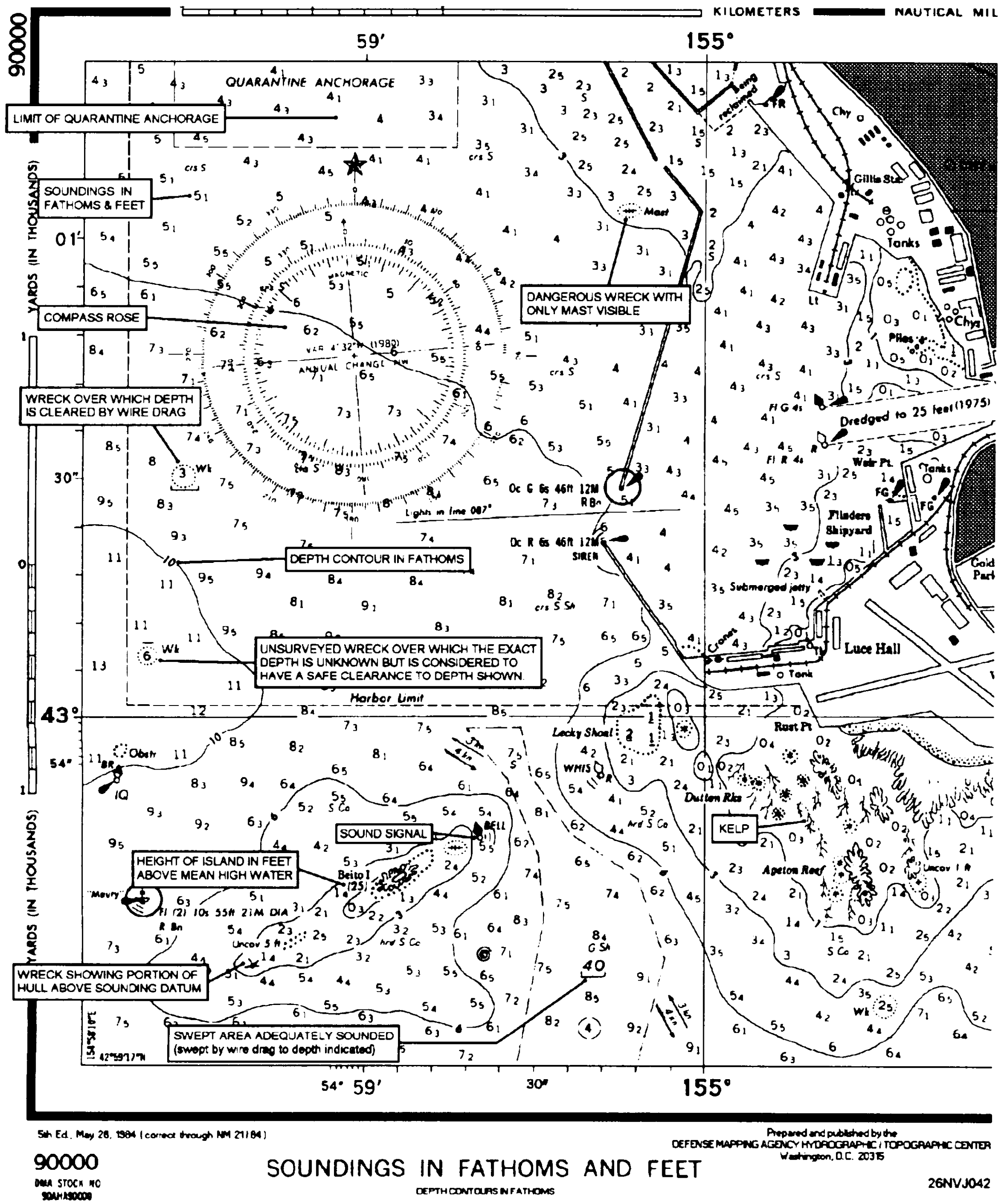

Figure 1-10. Sample of a nautical chart with features called out.

Nautical Chart Interpretation, Continued

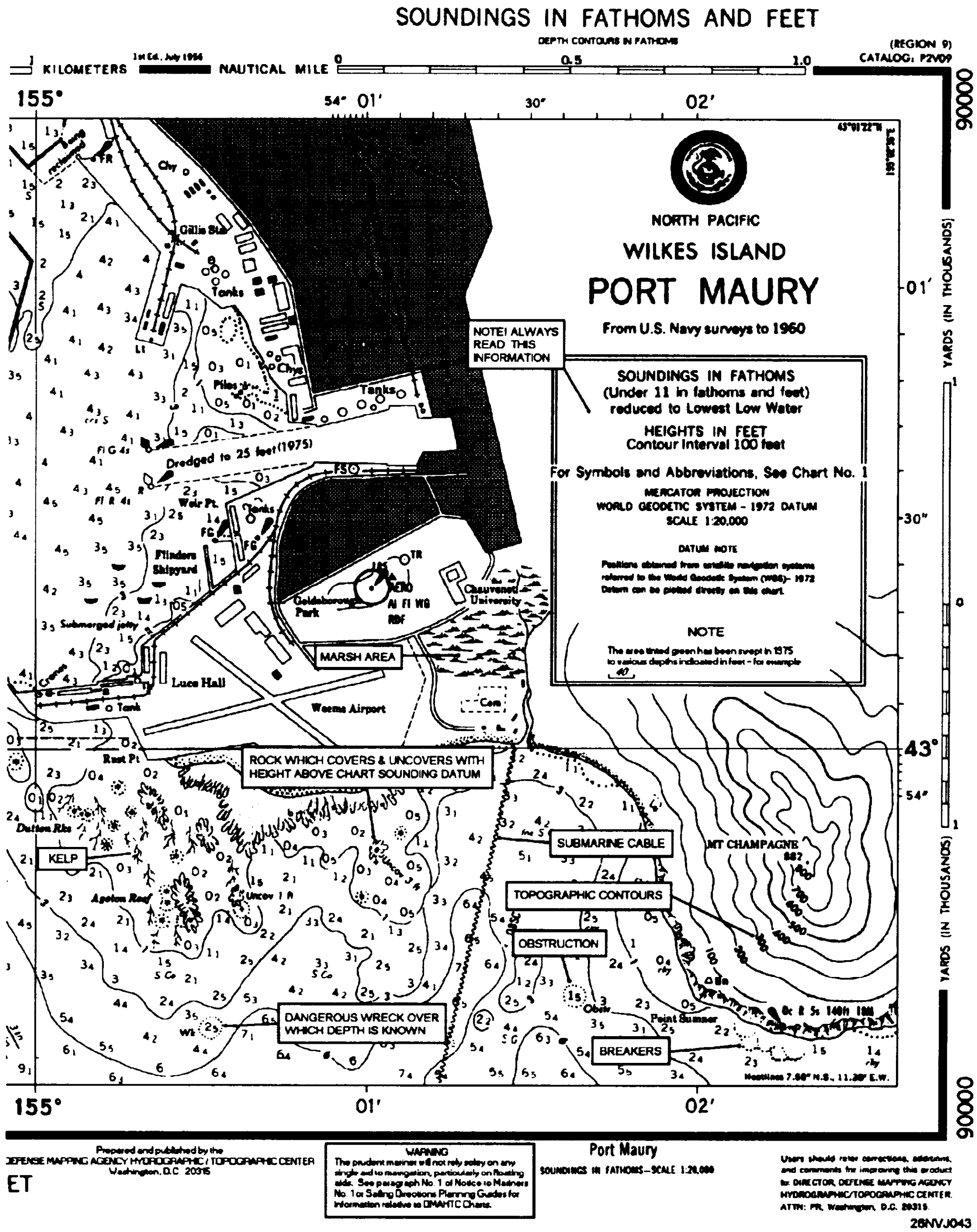

Figure 1-10. Sample of a nautical chart with features called out (continued).

Chart Scale

Information

The scale of a chart refers to a measurement of area, not distance. A chart covering a relatively large area is called a small-scale chart and a chart covering a relatively small area is called a large-scale chart. Scales may vary from 1: 1,200 for plans to 1: 14,000,000 for world charts. Normally, the major types of charts fall within the following scales:

Chart Type	From	To	Remarks
Harbor and Approach	1:1,000	1:50,000.	Used in harbors, anchorage areas, and the smaller waterways. Charts used for approaching more confined waters are called approach charts.
coast	1:50,000	1:150,000.	Used for inshore navigation, for entering bays and harbors of considerable width, and for navigating large inland waterways.
General and Sailing	1:150,000	1:6,000,000	Used for **coastal navigation** outside outlying reefs and shoals when the vessel is generally within sight of land or aids to navigation and its course can be directed by piloting techniques.

Understanding Chart Scales

The size of the area portrayed by a chart varies extensively according to the scale of the chart. The larger the scale, the smaller the area represented. It follows then that large-scale charts show areas in greater detail. Many features that appear on a large-scale chart do not, in fact, show up at all on a small-scale chart of the same area.

The scale to which a chart is drawn usually appears under its title in one of two ways: 1:25,000 or 1/25,000. These figures mean that an actual feature is 25,000 times larger than its representation on the chart. Expressed another way, an inch, foot, yard, or any unit on the chart means 25,000 inches, feet, or yards on Earth’s surface.

The larger the figure indicating the proportion of the scale, the smaller the scale of the chart. A chart with a scale of 1:25,000 is on a much larger scale, for instance, than one whose scale is 1:4,500,000.

Chart Accuracy

Information

Chart accuracy is hard to determine exactly. Several things need to be taken into consideration. The first and most important factor to consider is that a chart can be only as accurate as the survey on which it is based. To judge the accuracy and completeness of the survey, take note of its source and date. Usually, early survey dates indicate that the chart may have several irregularities. A chart must be tested before it may be used with a high degree of confidence. In heavily trafficked waters, a chart is normally quite accurate due to more thorough survey.

Tip: Another clue with which to determine accuracy is the abundance or absence of soundings. Infrequent soundings are an excellent indicator that the survey was not of great detail.

Chart Production

Compromise is sometimes necessary in chart production, as scale, clutter, and other factors may preclude the presentation of all information collected for a given area. The National Ocean Service publishes about 1,000 charts covering in excess of 86,000 miles of shorelines. DMAHTC publishes an even greater amount.

Caution

Charts are an aid to navigation and must be used with a certain amount of caution as they are not a complete guarantee of safety. Every QM team is responsible to report any changes or errors they may encounter on the charts they use. In the back of each Notice to Mariners is a form that may be filled out listing any discrepancies on charts. A radio message may also be sent to DMAHTC Attn: NTM.

Latitude and Longitude

Information

The latitude and longitude scales presented on the chart are broken down into whole degrees (fig. 1-11). Each degree is usually broken down into minutes on small-scale charts (remember, small scale = large area.) The large-scale chart breaks down even further into minutes (') and seconds ("). It is important that you understand these scales.

Remember that each degree (°) of latitude or longitude equals 60 minutes (60'), and that each minute (1') equals 60 seconds (60"). Seconds of latitude and longitude may also be expressed as a decimal fraction.

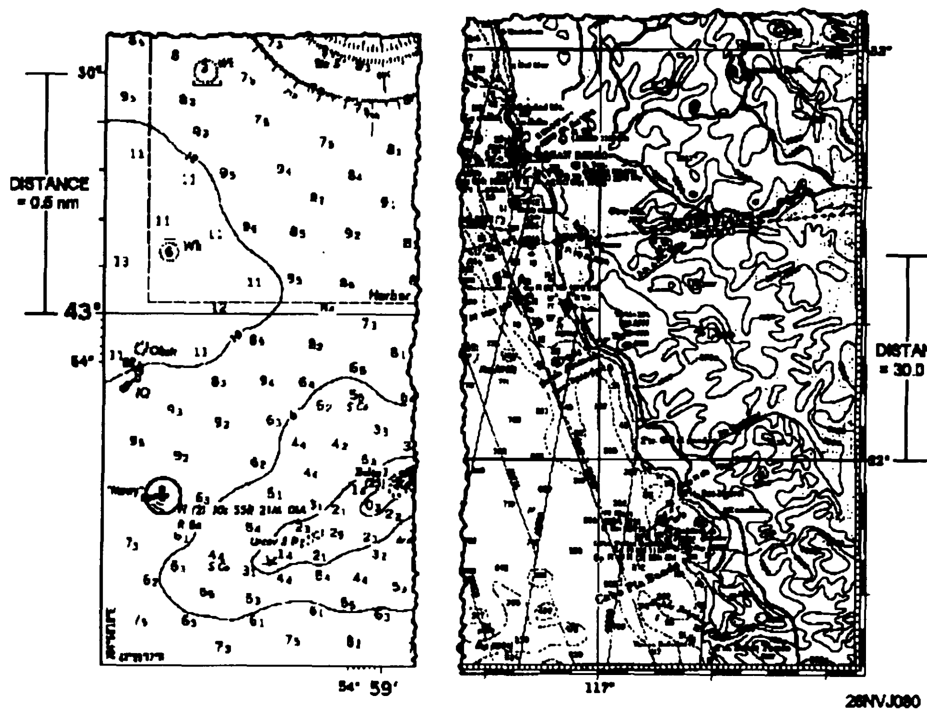

Figure 1-11. Latitude and longitude scales.

How to Measure Distance

Background Information

On Earth’s surface, 1° of latitude may be considered 60 nautical miles in length; whereas, the length of 1° of longitude varies with latitude. Therefore, the latitude scale must be used for measuring distance. Although this scale is expanded on a Mercator chart, the expansion is exactly equal to the expansion of distance at the same latitude. Therefore, in measuring distance on a Mercator chart, one must be careful to use the latitude and longitude scale in the area one is measuring. **NEVER use the longitude scale.**

How to Measure Distance

Use the table and figure 1-12 to learn how to measure distance on a nautical chart.

Step	Action
1.	Place one point of the dividers at the beginning of the area to be measured.
2.	Open the dividers to the desired distance to be measured.
3.	Move the dividers over to the closest latitude scale; **do not open or close the dividers!**
4.	Place one point of the dividers on a whole degree of latitude.
5.	Place the other point on the latitude scale.
6.	Determine the distance between the two points. (In figure 1-12, the measurement indicates 10 nmi.)

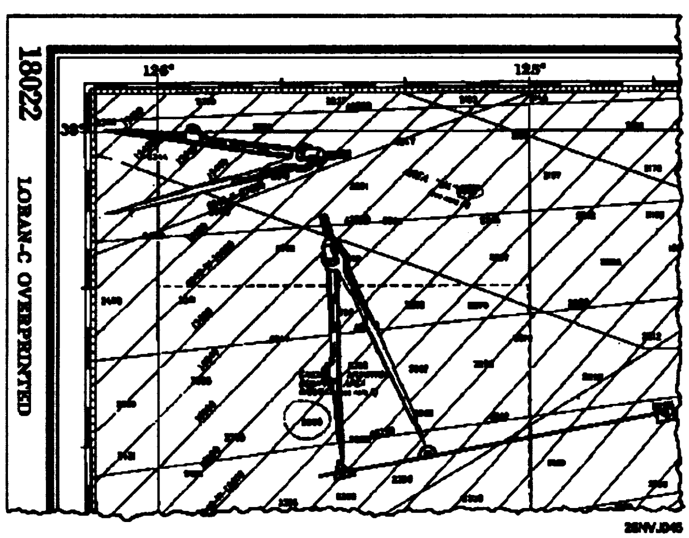

Figure 1-12. How to measure distance on a chart.

How to Determine or Plot Direction on a Chart

Background Information

Remember, meridians on a Mercator chart appear as straight lines, parallel to and equidistant from one another. You know they represent imaginary curved lines, not parallel to one another at all, but converging at the poles. Appearance of meridians on a Mercator projection as parallel straight lines is one of the most valuable features of this type of projection, making it possible to plot a course as a straight line (a rhumb line). On a Mercator projection, a rhumb line cuts every meridian at the same angle. In other words, it is a line of the same bearing throughout. Although it does not represent the shortest distance between the points it connects, this fact is not important unless very large distances are involved. Use the table and figure 1-13 to determine or plot direction.

Step	Action
1.	Identify the two points that you want to determine the direction to or from. Example: Pt A and Pt B.
2.	Lay one edge of the parallel rulers so that it passes through each point.
3.	Firmly press down on one side of the parallel rulers and begin to move the ruler to the compass rose.
4.	Position the ruler so either edge passes through the center crosshair of the compass rose.
5.	Use a pencil to mark the outside ring of the compass rose
6.	Read the bearing on the outside ring of the compass rose.

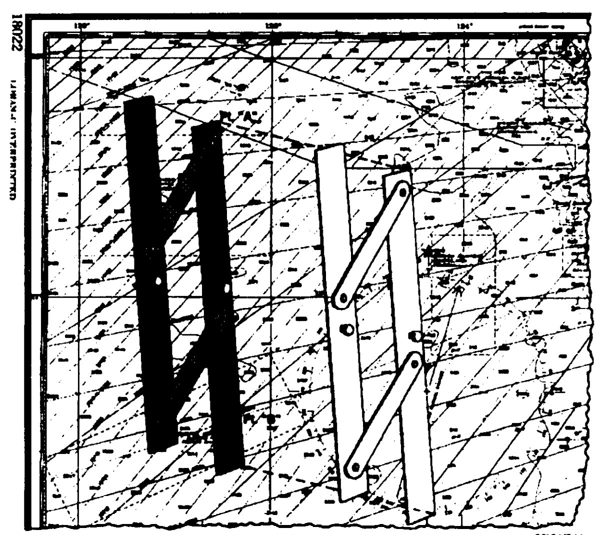

Figure 1-13. Plotting a position on a chart.

How to Plot a Position

How to Plot a Position

Now that we understand the latitude and longitude scales, we can learn how to plot a position. We can quickly and accurately plot any known position. Figure 1-14 will help illustrate this process. For example, a ship's position at 1800 (Lat. 36° 11'N, Long. 70° 17.5'W) can be plotted as follows:

Step	Action
1.	Find the latitude, 36° 11'N, on the latitude scale.
2.	Place the point of the compass on 36° and measure up 11'; now mark the scale with the compass lead.
3.	Without opening or closing the compass, move the point of the compass over to the proper meridian. In this case it is 70°. Now mark the meridian with the latitude measurement.
4.	Next we will find our longitude 70° and measure 17.5'. Care must be taken to measure towards the west or left, towards the next higher longitude. Now we will use our lead to mark off 17.5'.
5.	Now move the compass point up to the 36° parallel and mark off 17.5'. Continue to move up the 70th meridian to the point where you marked off the latitude (36°11'N) and mark off your longitude. You will now mark off the longitude once again, this time making a small arc.
6.	Now place the point of the compass on the 36° parallel at the point where the 70° 17.5' W is marked. Now mark a small arc that will cross the longitude mark. That's it, the point where the two arcs intersect is the position.

How to Extract Latitude and Longitude from a Known Position

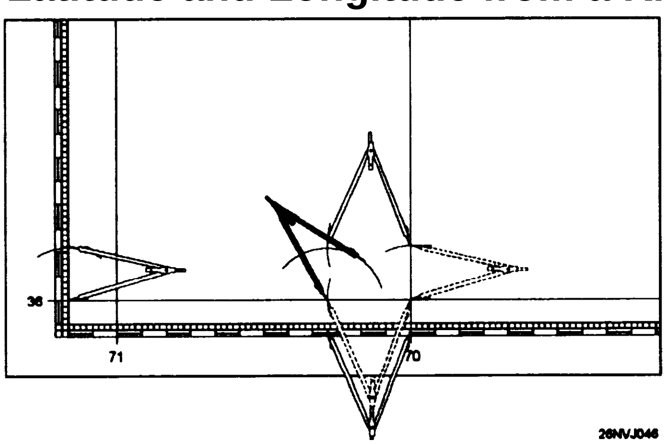

Figure 1-14. How to plot a position.

How to Extract Latitude and Longitude from a Known Position

You have now learned how to plot a position. Now let's extract the latitude and longitude from a known position. Let's find the position of the fix labeled 1520 in figure 1-15 . This is easily accomplished by following these steps:

1. Place the point of the compass directly beneath the position to be extracted on the closest parallel. Now open the compass and swing an arc that passes through the position.

2. Move your compass over to the latitude and read the latitude from the scale. Now repeat the procedure using the closest meridian as a reference.

You have now learned how to plot and extract positions on the chart. Hopefully, the previous discussion on the terrestrial coordinate system is now clear. If not, now is a good time to review the material once again. Let's continue to take a closer look at our chart, where it comes from, how it is kept up to date.

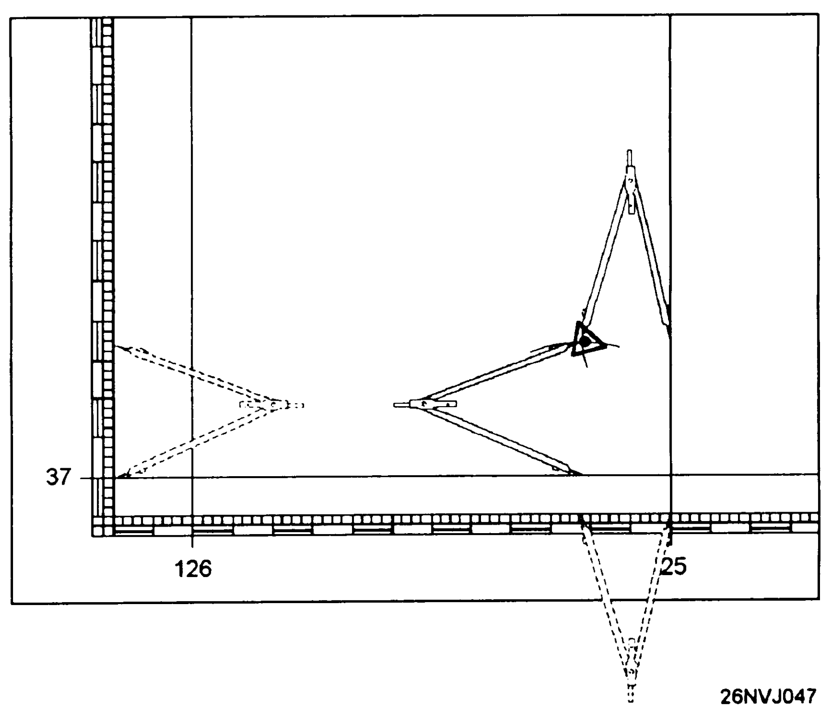

Figure 1-15. That's it, the point where the two arcs intersect is the position.

Defense Mapping Agency

Background Information

Charts used in the Navy may be prepared by the Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC), the National Ocean Service (NOS), the British Admiralty, or by other hydrographic agencies. Whatever the source, all charts used by the Navy are issued by DMAHTC. In this last portion of the chapter you will learn how determine chart coverage and select charts for any area in the world. How charts are numbered and the portfolio designations. The system used to correct charts and techniques used to make corrections. We will also discuss the chart ordering system.

DMA Pub 1-N

The Defense Mapping Agency (DMA) *Catalog of Maps, Charts, and Related Products* is a four-part catalog published by the Defense Mapping Agency Office of Distribution Services (DMAODS). It provides a comprehensive reference of all DMA maps, charts, and related products available. It is organized as follows:

PART I-AEROSPACE PRODUCTS

PART 2-HYDROGRAPHIC PRODUCTS

Volume I United States and Canada (Region 1)
Volume II Central and South America and Antarctica (Region 2)
Volume III Western Europe, Iceland, Greenland, and the Arctic (Region 3)
Volume IV Scandinavia, Baltic, and USSR (Region 4)
Volume V Western Africa and the Mediterranean (Region 5)
Volume VI Indian Ocean (Region 6)
Volume VII Australia, Indonesia, and New Zealand (Region 7)
Volume VIII Oceania (Region 8)
Volume IX East Asia (Region 9)
Volume X Miscellaneous Charts and Publications
Volume XI (SECRET) Classified Charts and Publications (U)
Semiannual Bulletin Digest for Hydrographic Products
Monthly Bulletin for Hydrographic Products
(CONFIDENTIAL) Quarterly Bulletin for Classified Hydrographic Products (U)

PART 3-TOPOGRAPHIC PRODUCTS

PART 4-TARGET MATERIAL PRODUCTS

Catalog

As you have seen from the organization of the DMA catalog, part 2 deals with hydrographic products. This is the only part that you will normally use as a Quartermaster. Each of the 11 volumes in part 2 contains graphic indexes and numerical listings of charts and other products.

The listings also include chart edition numbers and dates. Navigational and oceanographic publications are contained in volumes X and XI. The title and date of each publication are shown. The price is noted for each chart and publication available for sale to the public. The ordering procedures are contained in volumes X and XI.

Hydrographic Bulletins

The Semiannual Bulletin Digest for Hydrographic Products is published in June and December. It provides a complete listing of all available unclassified charts and publications. The Monthly Bulletin for Hydrographic Products is issued the other 10 months between issues of the Semiannual Bulletin Digest. New and revised charts and publications issued are reported on a month-to-month basis in the Monthly Bulletin. The old edition for a chart must not be disposed of until the latest edition arrives on board.

All information reported in the Monthly Bulletin is cumulative. This means that only the latest Semiannual Bulletin Digest and Monthly Bulletin need to be held for you to have current information on all available hydrographic products. Information appearing for the first time is marked with an asterisk. The Quarterly Bulletin for Classified Hydrographic Products is published in January, July, and October, with volume XI being reissued in April. The Quarterly Bulletin provides a complete summary of all available classified charts and publications. The bulletins should be filed and used to correct your catalog volumes. They will also allow you to check and confirm that you hold the latest editions of charts and publications in your inventory and that you are not missing any charts from your required allowance. The charts listed as canceled are to be disposed of.

DMA Stock Numbering System

Background Information

A five-digit alphanumeric series designator prefix has been assigned to each standard nautical chart number (fig. 1-16). The purpose of this prefix is to speed up requisition processing and to improve inventory management by the DMA. It is listed in the lower left-hand comer of many charts, along with the chart edition number and date.

As illustrated in figure l-16 the first two digits of the prefix reflect the geographical subregion in the same manner as the first two digits of the basic chart number. The third position is the portfolio assignment, A or B. X is used if the chart is not included in a portfolio. The fourth and fifth positions are alphabetical designators for the type of chart.

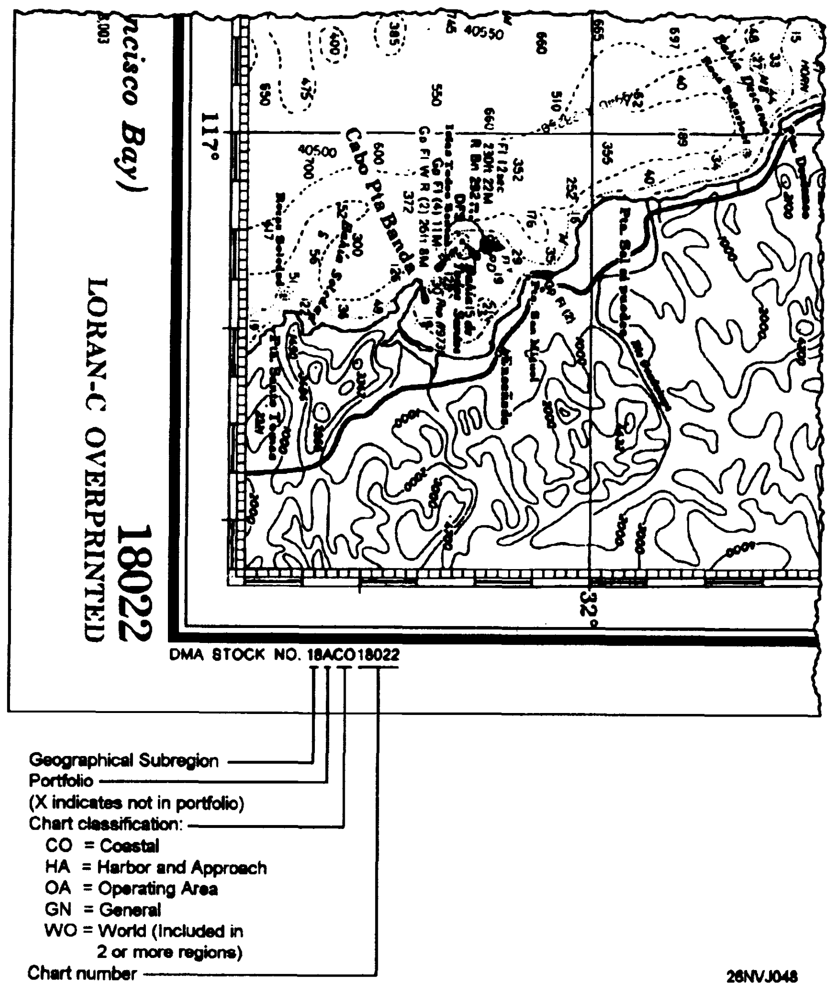

Figure 1-16. DMA stock numbering.

The Nautical Chart Numbering System

Background Information

DMA assigns a number to every nautical chart used by the U.S. Navy, regardless of the organization producing the chart. Charts produced by the NOS, and charts of foreign governments are also assigned numbers by DMA so that they may be filed in sequence with the

DMAHTC-produced charts. DMA charts have numbers consisting of **one** to **five** digits. The number of digits generally indicates the scale range, and the number itself indicates the geographical area covered by the chart. The chart numbering system is as follows:

Number of Digits	Scale	Description
1 (1-9)	None	Symbol and flag charts.
2 (10-99)	1:9,000,000 and smaller	These charts depict a major portion of an ocean basin or a large area, with the first digit identifying the ocean basin.
3 (100-999)	Between 1:2,000,000 and 1:9,000,000.	These are general charts whose numbers are based on the nine ocean basins.
4 (5000-9999)	Various	This category includes great circle tracking charts, electronic navigation system plotting charts, and special-purpose non-navigational charts and diagrams. Four-digit charts with a letter prefix (EOIOI-E8614) are bottom contour charts.

Number of Digits	Scale	Description
5 (11000-99999)	Larger than 1:2,000,000	In this category are all standard nautical charts at a scale larger than 1:2,000,000. At scales such as this, the charts cover portions of the coastline rather than significant portions of ocean basins.
6 (800000-809999)		This category consists of combat charts and combat training charts. A random numbering system is used to prevent the identification of the geographical area covered by a classified combat chart without referring to the catalog. One reason for this is to allow you to order classified combat charts with an unclassified requisition.

Note The five-digit category contains all the large-scale and medium-scale charts of the world. These are the primary nautical charts. The five-digit charts are based on the nine regions of the world, as shown in figure 1-15. The first of the five digits indicates the region in which the chart is depicted. The first and second digits together indicate the geographic subregion within the region, and the last three digits identify the geographic order of the chart within the subregion.

Chart Correction System

Background Information

The Chart/Publication Correction Record Card System is used to conserve nautical charts and publications and to reduce the amount of chart correction work aboard ship. The *Notice to Mariners, Local Notice to Mariners, Summary of Corrections,* NAVTEX and SafetyNet are considered component parts of the system.

The Chart/Publication Correction Record Card, shown in figure 1-17, is designed for use in recording all *Notice to Mariners* corrections affecting charts and publications held on board. Initially, the cards are furnished to Navy ships. Additional cards may be ordered from DMAODS. With this record, only the charts and publications of the operating area need be corrected (ready charts).

Charts and publications not immediately required for use may be updated as areas of operations change or as directed by the commanding officer. A record must be maintained for *Notice to Mariners* corrections to all charts and publications carried aboard, with actual corrections being made on all charts and publications before they are used for navigational purposes. **Never use an uncorrected chart for navigation purposes.**

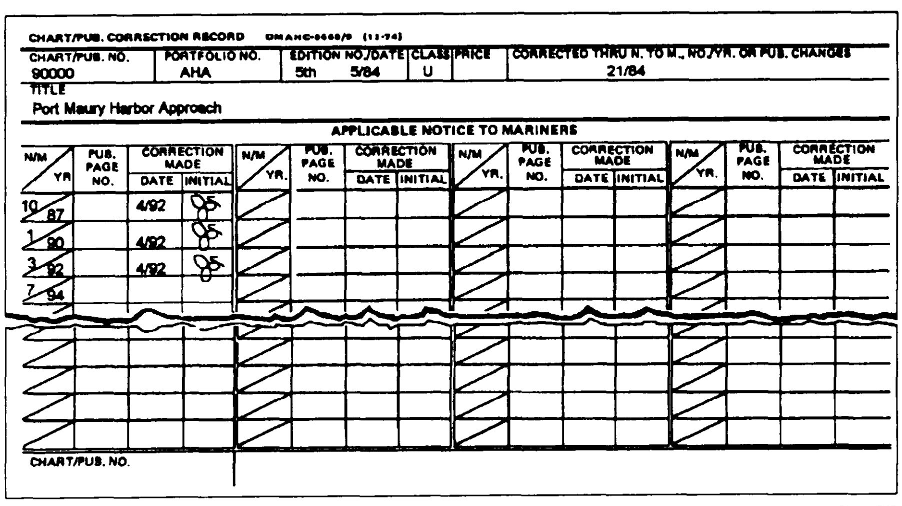

Figure 1-17. Example of a completed Chart/Publication Correction Record Card.

Notice to Mariners

Background Information

The chart and publication correction system is based on the periodical, *Notice to Mariners*, published weekly by the DMAHTC and the *Local Notice to Mariners* also published by the U.S Coast Guard weekly to inform mariners of corrections to nautical charts and publications. This periodical announces new nautical charts and publications, new editions, cancellations, and changes to nautical charts and publications. It also summarizes events of the week as they affect shipping, advises mariners of special warnings or items of general maritime interest, and includes selected accounts of unusual phenomena observed at sea. Distribution of the *Notice to Mariners* is made weekly to all U.S. Navy and Coast Guard ships and to most ships of the merchant marine.

The classified Chart and Publication Correction System is based on the *Classified Notice to Mariners*, published on an as-needed basis by the DMAHTC to inform mariners of corrections to classified nautical charts and publications.

The *Notice to Mariners* provides information specifically intended for updating the latest editions of nautical charts and publications issued by the Defense Mapping Agency, the National Ocean Service, and the U.S. Coast Guard. When the *Notice to Mariners* is received, it should be examined for information of immediate value. The list of new charts and new editions of charts and publications should also be checked to assure that the latest editions are on board.

In section I of the *Notice to Mariners*, chart corrections are listed by chart number, beginning with the lowest and progressing in sequence through each chart affected. The chart corrections are followed by publication corrections, which are also listed in numerical sequence. Since each correction pertains to a single chart or publication, the action specified applies to that particular chart or publication only. If the same correction also applies to other charts and publications, it is listed separately for each one.

Figure 1-18 illustrates the Notice to Mariners format for presenting corrective information affecting charts. A correction preceded by a star indicates that it is based on original U.S. source information. If no marking precedes the correction, the information was derived from some other source. The letter T preceding the correction indicates the information is temporary in nature, and the letter P indicates it is preliminary. Courses and bearings are given in degrees clockwise from 000° true.

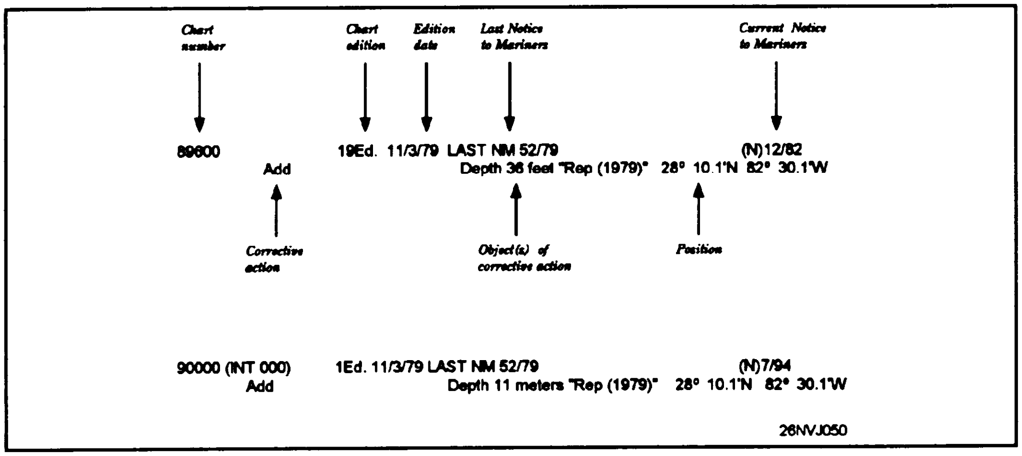

Figure 1-18. Notice to Mariners format.

Automated Notice to Mariners System (ANTMS)

The ANTMS is used by the DMAHTC to process navigational data and to produce the *Notice to Mariners,* the *Summary of Corrections,* the *List of Lights,* and *Sailing Directions.* Your ship can query the ANTMS by message to obtain the latest navigation information while you are at sea.

For example, this could be of great importance if you have not received the most recent issues of Notice to Mariners and want to check for the latest corrections to charts you will be using to enter your next port. Instructions explaining how to gain access to the ANTMS may be obtained by writing to the DMAHTC, Attention: NVS, and requesting a copy of the Automated Notice to Mariners Communications Users Manual.

Local Notice to Mariners

The *Local Notice to Mariners* is published weekly by the U.S. Coast Guard. It contains information of a local nature. As the U. S. Coast Guard is responsible for maintaining all U.S. Aids to Navigation, they report any changes that may have been made. This may include information such as the movement of buoys and markers, and changes in depth of the water due to dredging. It will also contain information on bridge closings, harbor restrictions, and general information concerning harbors and local coastal areas.

Background Information

Whenever a ship is under way, it is necessary to receive information concerning any hazards in the area that the ship may be operating. Broadcast warnings fulfill this requirement. In recent years a system has been established that notifies mariners by radio messages. All messages are broken down into two categories. The first category is called *Hydros. Hydrolants* cover warnings in the Atlantic Ocean, *Hydropacs* cover the Pacific Ocean. The second category is called *Navareas,* which covers specific areas. *Navareas* contain information that advises mariners of operating area warnings. An example would be a navigation aid adrift. Refer to section III of the NTM for more information. Broadcast warning message boards must be updated from the weekly NTM.

NAVTEX

To meet changing requirements and to provide better service using the latest technology, DMAHTC has worked with the Navy to provide up-to-date warning information. Thus the *NAVTEX* part of *NAVINFONET* (fig. 1-19) system has evolved and is currently going into place on all fleet units.

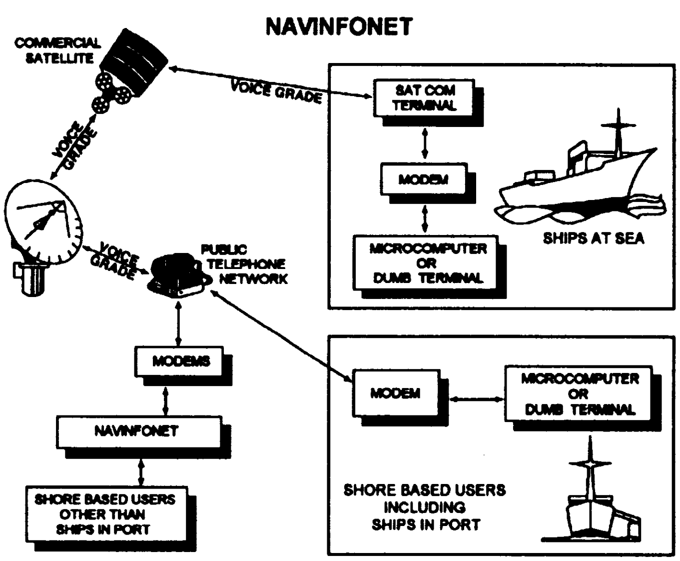

Figure 1-19. Components of GMDSS (from Pub 117).

NAXTEX will completely replace the Hydros and Navareas warnings sometime in the future. Refer to the NAVTEX receiver instruction manual for complete information.

Summary of Corrections

Background Information

The *Summary of Corrections* (fig. l-20) is a six-volume cumulative summary of corrections to charts and publications previously published in the *Notice to Mariners.* The summary is used when you are correcting any chart that has not been previously corrected. For example, a chart lists twelve corrections. The summary contains all corrections through 6/93. Of the twelve corrections, ten are contained in the summary, the other two must be obtained from the applicable NTM. This saves time because instead of pulling twelve NTM, you only pull two.

Volumes Published

DMAHTC publishes each of the five unclassified volumes semiannually and the classified volume annually. They are organized as follows:

Volume I -East Coast of North and South America
Volume 11 -Eastern Atlantic and Arctic Oceans including the Mediterrean Sea
Volume Ill-West Coast of North and South America including Antarctica
Volume IV-Western Pacific and Indian Ocean
Volume V -World and Ocean Basin Charts, U.S. Coast Guard Pilots, Sailing Directions, Fleet Guides, and other Publications

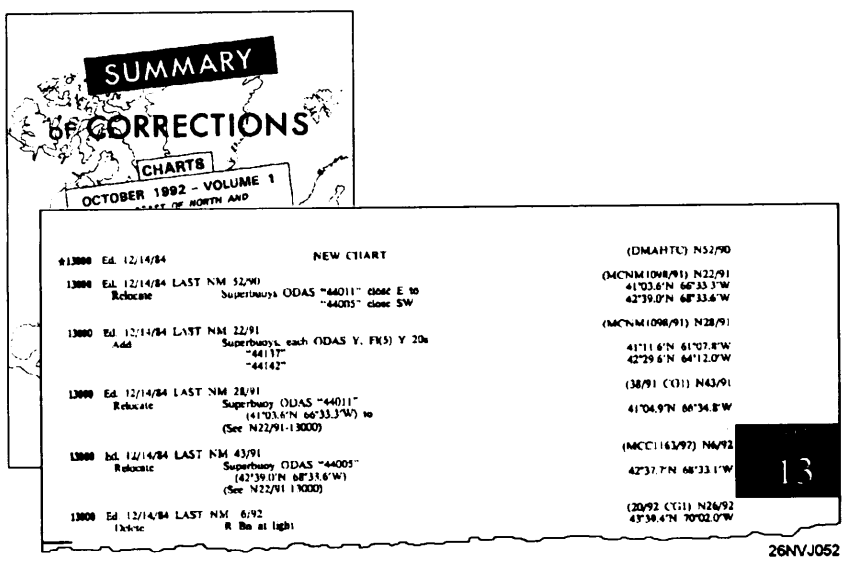

Figure 1-20. Summary of Corrections.

Chart Card Maintenance

Background Information

Before we can learn how to correct the charts we want to use, we need to learn the chart card system. The chart card system evolved from a need to have a standard method of recording NTM corrections. It wouldn't be practical to correct each and every chart listed in the weekly NTM. The chart card systems allows the Quartermaster to record on a card the NTM year and number for each chart in the ship's allowance as changes are made to these charts. Then the chart may be corrected as it is needed.

Illustrated in figure 1-21 are the steps to be followed to maintain the card system. These steps are generic, individual units may need to modify them to suit their needs. The following is a brief description of the steps:

Step	Action
1.	The weekly Notice to Mariners is received on board.
2.	The ready charts and any charts currently in use are checked against the NTM to see if any need correction. **Example:** write the NTM number (4/93) on the card, and put the card(s) aside in a pile for later chart correction listed in step five
3.	Charge all affected cards. To charge cards means to enter on the card the NTM number and year. See figure 1-18. This must be done for publications also and in the same manner.
4.	Update the broadcast message boards as needed from section III of the NTM.
5.	Correct ready charts and any affected charts that may be in use as identified in step 2.
6.	Correct any publications as listed in section II.
7.	Pull (remove) all canceled charts and cards and destroy.
8.	Make cards for new charts.

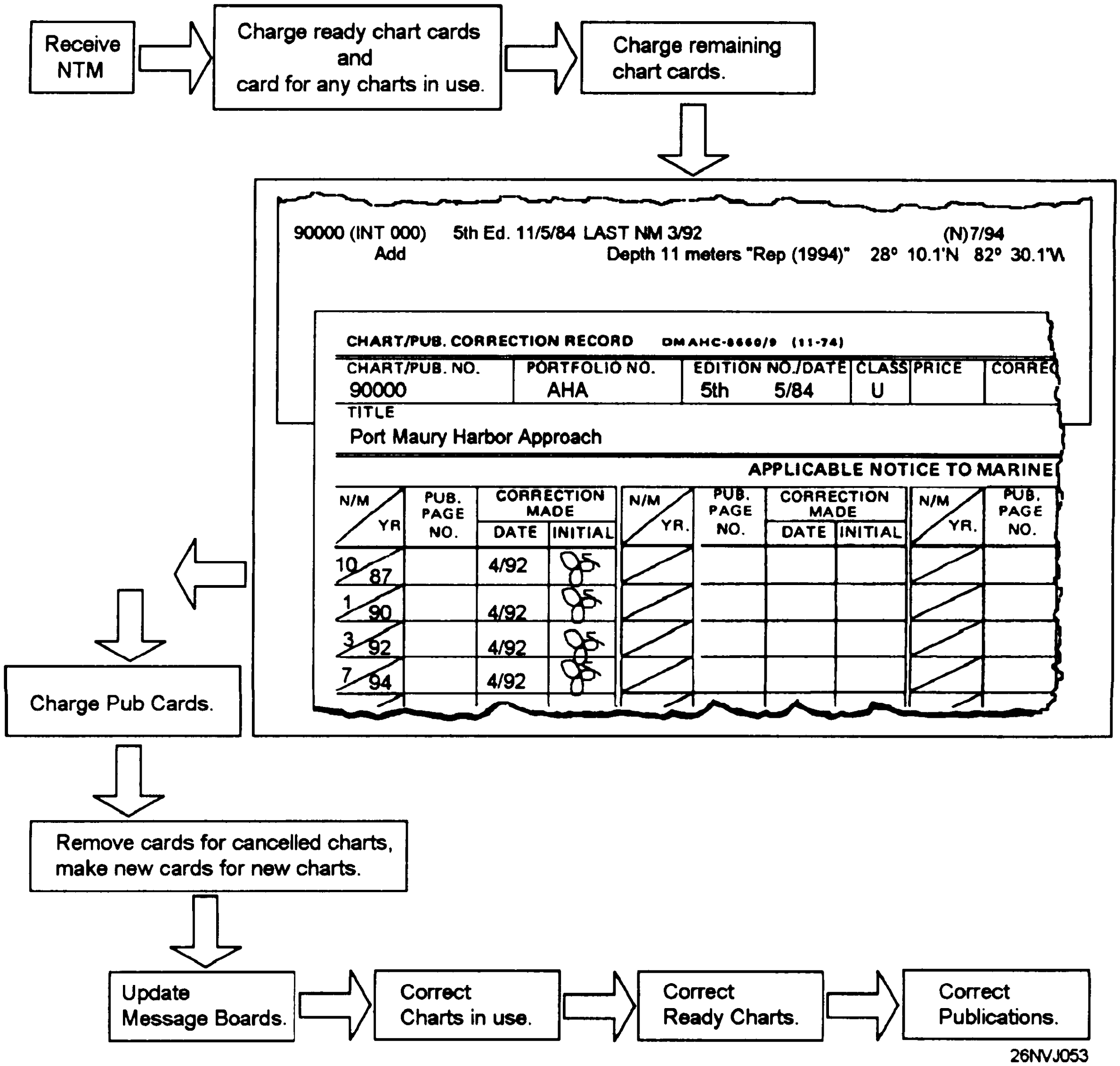

Figure 1-21. Charging the card deck.

Note: When a new edition is listed in the NTM, the card must be annotated as follows: NTM 6/93 *N.E.* This indicates that a new edition is ready for issue. DO NOT DISCARD the old edition until the new one arrives.

Chart Correction Techniques

Background Information

After a little practice on obsolete charts, corrections to printed information on nautical charts can be made neatly and quickly. These corrections become a permanent part of the chart and may involve the safety of the ship. Corrections must be made in ink so they will not be accidentally erased when you are cleaning the chart after use. The only instruments necessary to correct charts are several high-quality ball-point pens or central feed technical fountain pens, a variety of stick or pencil-type erasers, and typographical correction fluid.

Correction Techniques

Example: The NTM states that you are to add a buoy at 25°10'33"N 70°21'12"W. Locate the coordinates on the chart, determine if you need to erase part of the chart to insert the buoy. If necessary erase or use typing correction fluid (white out). **NOTE:** ***Any information that is removed from a chart must be redrawn after the correction is made. This calls for the person effecting the correction to use some degree of judgment.***

Use the chart correction template (fig. 1-22, available from DMAHTC) to draw the buoy on the chart. Write in any information about the buoy. Chart correction may be completed in many ways. It is wise to purchase additional templates from local sources that carry drafting supplies. As a rule, corrections must always be neat and legible. Never use red ink to make corrections to a chart. The Navy uses red lighting at night. Red ink will disappear under red lights, making the correction invisible and putting the ship at risk. **DO NOT USE RED INK!**

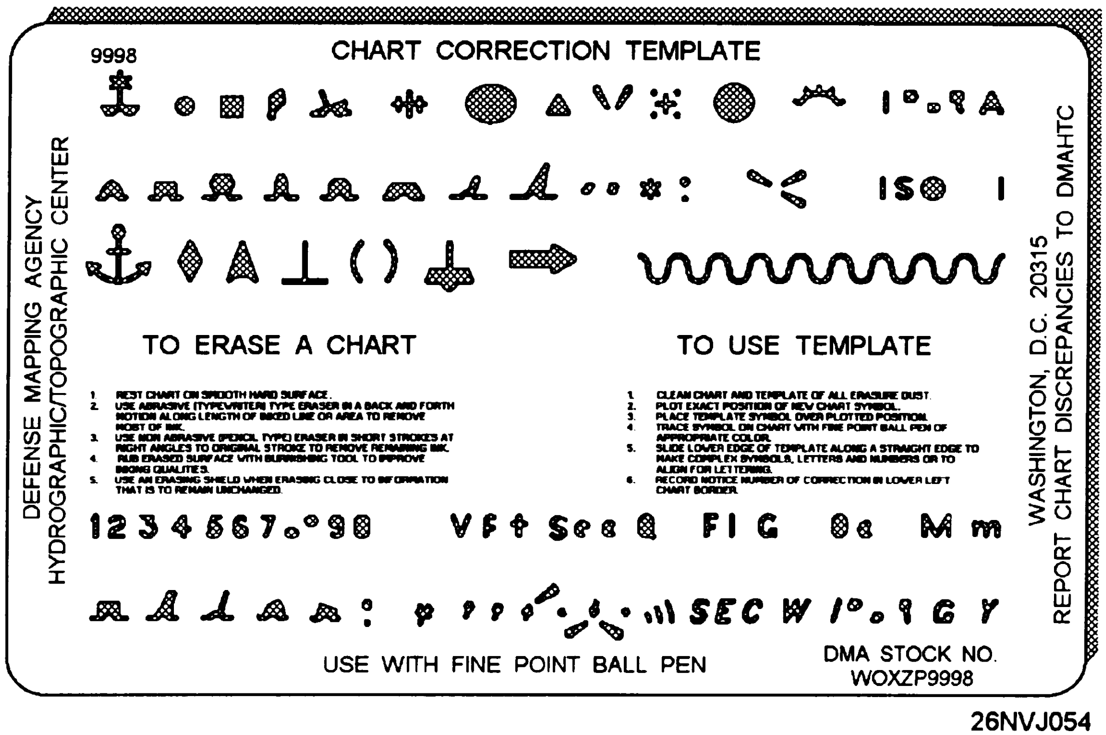

Figure 1-22. Chart correction template.

Correction Techniques

<u>Time Saver:</u> When correcting charts that have accumulated numerous corrections, it is more practical to make the latest correction first and work backwards since later corrections may cancel or alter earlier corrections. Remember to use the *Summary of Corrections.*

Chartlet Correction

Chartlet corrections (pasters) appearing in the back of section I of the *Notice to Mariners* are to be affixed to the chart in the proper area. They must be glued in place. Any outstanding temporary changes must be transferred to the chartlet. Temporary changes in *Aids to Navigation* are not plotted by the DMA. It may be necessary to pen in lengthy notes on a chart. It is desirable to photocopy the note from the NTM and paste it on the chart whenever possible.

Chart Ordering System

Background Information

When a ship is first commissioned, it is outfitted by DMAODS with its initial allowance of charts and publications. During normal operations, some charts will wear out and requirements for additional copies of high-use charts will be established. New and revised charts and publications are received by your ship through the Automatic Initial Distribution (AID) System, which will be discussed later in this chapter.

The DMAODS issues all DMA maps, charts, and publications. A major unit of the DMAODS is its DMA Distribution Control Point (DDCP) in Washington, DC. **Submit all requisitions to DDCP.** ***Improper planning on your part does not constitute a crisis for local offices of DMA.*** **When you use a chart, always order a new chart in a timely manner.**

DMA Branch Offices

The DMA offices and branch offices stock limited quantities of products to meet immediate operational needs. You may obtain products from them if time does not permit you to submit a requisition to the DDCP. When you visit a DMA office or branch office, be sure that you carry a completed requisition form with you. This form **must** be signed by the commanding officer.

Chart Allowances

The basic load of maps, charts, and publications your ship is required to hold is prescribed in allowance instructions issued by your fleet commander or type commander. In some cases a ship may have a permanent allowance that is supplemented by another allowance that will cover the area to which the ship deploys. In such cases your deployment allowance is normally requested by your type commander from DMAODS about 3 months before your deployment. You should become familiar with the allowance instructions that pertain to your ship.

Automatic Initial Distribution (AID)

AID refers to the automatic issue of predetermined quantities of new or revised products. AID is the means by which your ship's allowances of charts and publications is kept current with no requisitioning action required on your part. Annually the DMAODS forwards to each U.S. Navy ship on AID a computer listing, called an AID Requirements for Customer Report (R-05), to allow the command to confirm its allowance holdings. Upon receipt, an annual inventory must be conducted.

Ordering, Labelling, and Stowing Charts

Ordering Charts The ordering of charts is now primarily accomplished with the help of a personal computer (PC). With the growth of computer technology, DMAHTC has written the ***GETAMAP*** program to aid in the ordering of charts. Complete step by step ordering procedures are contained in DMAHTC publication 1-N.

Labelling and Stowing Charts All charts have labelling requirements. To properly label each chart you must first fold it correctly. Start with the chart laying flat with the printed side facing up. Now fold the left side to the right side, turn the chart 90° and fold in half again. Refer to figure 1-23, note that the labelling includes a five-digit chart number, latest edition number and date, and the latest NTM that the chart is corrected through.

Charts are stowed in numerical order by regions. Care must be taken not to bend or damage charts when placing them in to the chart drawers. Several copies of the same chart should be placed inside of one copy.

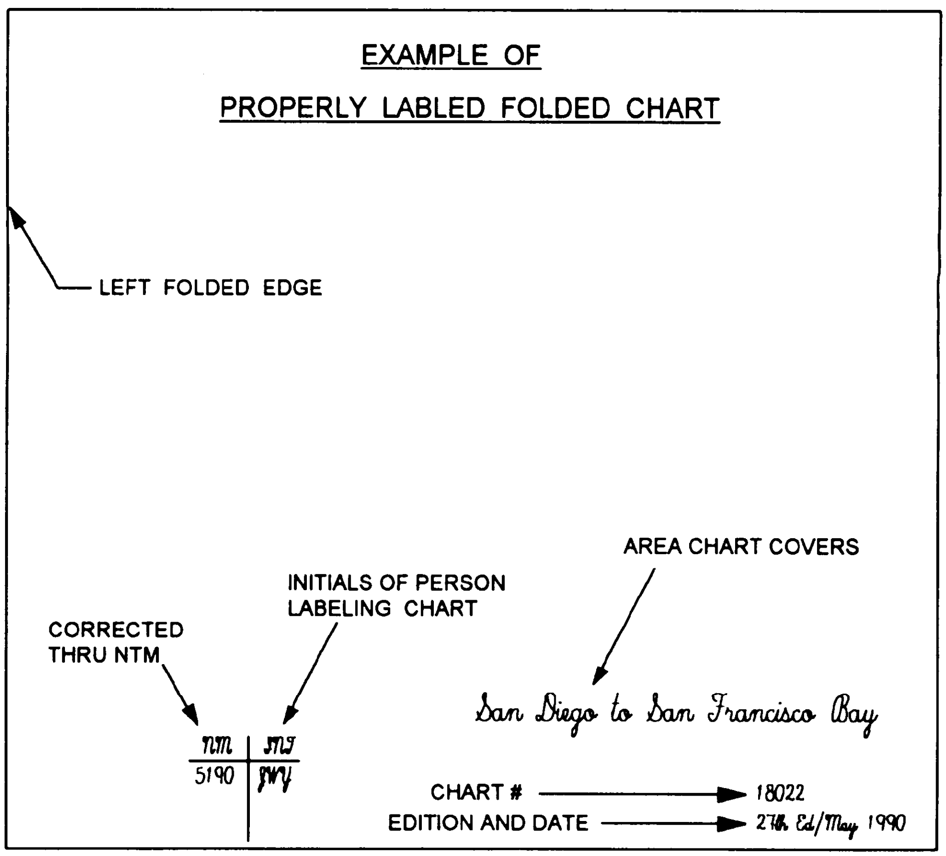

Figure 1-23. Properly folded chart.